

INTERNATIONAL STANDARD

IEC
61019-1

First edition
2004-11

Surface acoustic wave (SAW) resonators –

**Part 1:
Generic specification**

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International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

SURFACE ACOUSTIC WAVE (SAW) RESONATORS –

Part 1: Generic specification

FOREWORD

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- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61019-1 has been prepared by IEC technical committee 49: Piezoelectric and dielectric devices for frequency control and selection.

This first edition of IEC 61019-1 cancels and replaces the first edition of IEC 61019-1-1 published in 1990 and the first edition of IEC 61019-1-2 published in 1993. It constitutes a technical revision.

The text of this standard is based on the following documents:

FDIS	Report on voting
49/689/FDIS	49/698/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO IEC Directives, Part 2.

IEC 61019 consists of the following parts under the general title *Surface acoustic wave (SAW) resonators*:

Part 1: Generic specification

Part 2: Guide to the use (at present under revision)

Part 3: Standard outlines and lead connections

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

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SURFACE ACOUSTIC WAVE (SAW) RESONATORS –

Part 1: Generic specification

1 Scope

This part of IEC 61019 specifies the methods of test and general requirements for SAW resonators using either capability approval or qualification approval procedures of the IECQ system.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60027 (all parts), *Letter symbols to be used in electrical technology*

IEC 60050-561:1991, *International Electrotechnical Vocabulary (IEC) – Chapter 561: Piezo-electric devices for frequency control and selection*

IEC 60068-1:1988, *Environmental testing – Part 1: General and guidance*

IEC 60068-2-1:1990, *Environmental testing – Part 2: Tests – Tests A: Cold*

IEC 60068-2-2:1974, *Environmental testing – Part 2: Tests – Tests B: Dry heat*

IEC 60068-2-6:1995, *Environmental testing – Part 2: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-7:1983, *Environmental testing – Part 2: Tests – Test Ga and guidance: Acceleration, steady state*

IEC 60068-2-13:1983, *Environmental testing – Part 2: Tests – Test M: Low air pressure*

IEC 60068-2-14:1984, *Environmental testing – Part 2: Tests – Test N: Change of temperature*

IEC 60068-2-17:1994, *Environmental testing – Part 2: Tests – Test Q: Sealing*

IEC 60068-2-20:1979, *Environmental testing – Part 2: Tests – Test T: Soldering*

IEC 60068-2-21:1999, *Environmental testing – Part 2-21: Tests – Test U: Robustness of terminations and integral mounting devices*

IEC 60068-2-27:1987, *Environmental testing – Part 2: Tests – Test Ea and guidance: Shock*

IEC 60068-2-29:1987, *Environmental testing – Part 2: Tests – Test Eb and guidance: Bump*

IEC 60068-2-30:1980, *Environmental testing – Part 2: Tests – Test Db and guidance: Damp heat, cyclic (12 + 12-hour cycle)*

IEC 60068-2-32:1975, *Environmental testing – Part 2: Tests – Test Ed: Free fall*

IEC 60068-2-45:1980, *Environmental testing – Part 2: Tests – Test XA and guidance: Immersion in cleaning solvents*

IEC 60068-2-52:1996, *Environmental testing – Part 2: Tests – Test Kb: Salt mist, cyclic (sodium chloride solution)*

IEC 60068-2-58:1999, *Environmental testing – Part 2-58: Tests – Test Td: Test methods for solderability, resistance to dissolution of metallization and to soldering heat of surface mounting devices (SMD)*

IEC 60068-2-64:1993, *Environmental testing – Part 2: Tests – Test Fh: Vibration, broad-band random (digital control) and guidance*

IEC 60068-2-78:2001, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC 60617 – DB:2001¹ *Graphical symbols for diagrams*

IEC 60122-1:2002, *Quartz crystal units of assessed quality – Part 1: Generic specification*

IEC 60444 (all parts), *Measurement of quartz crystal unit parameters*

IEC 61000-4-2:1995, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 2: Electrostatic discharge immunity test*. Basic EMC Publication

IEC 61019-2:1995, *Surface acoustic wave (SAW) resonators – Part 2: Guide to the use*

IEC 61019-3:1991, *Surface acoustic wave (SAW) resonators – Part 3: Standard outlines and lead connections*

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QC 001001:2002, *IEC Quality Assessment System for Electronic Components (IECQ) – Basic Rules*

QC 001002-2:1998, *IEC Quality Assessment System for Electronic Components (IECQ) – Rules of Procedure – Part 2: Documentation*

QC 001002-3:1998, *IEC Quality Assessment System for Electronic Components (IECQ) – Rules of Procedure – Part 3: Approval procedures*

QC 001005:2003, *IEC Quality Assessment System for Electronic Components (IECQ) – Register of Firms, Products and Services approved under the IECQ System, including ISO 9000*

ISO 1000:1992, *SI units and recommendations for the use of their multiples and of certain other units*

¹ DB refers to the IEC on-line database.

3 Order of precedence

Where any discrepancies occur for any reason, documents shall rank in the following order of precedence:

- the detail specification;
- the sectional specification;
- the generic specification;
- any other international document (for example, of the IEC) to which reference is made.

The same order of precedence shall apply to equivalent national documents.

4 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

Units, graphical symbols, letter symbols and terminology shall, wherever possible, be taken from the following standards: IEC 60027, IEC 60050-561, IEC 60122-1, IEC 60617, IEC 60642, ISO 1000.

4.1 General terms

4.1.1

surface acoustic wave (SAW)

acoustic wave, propagating along the surface of an elastic substrate, whose amplitude decays exponentially with substrate depth

4.1.2

surface acoustic wave resonator (SAW resonator or SAWR)

resonator using multiple reflections of surface acoustic waves

4.1.3

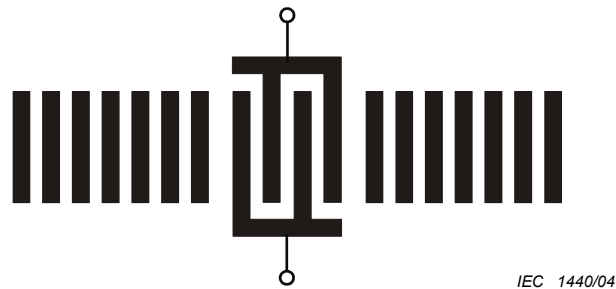
one-port resonator

SAW resonator having a pair of terminals (see 4.2.10 and Figure 1)

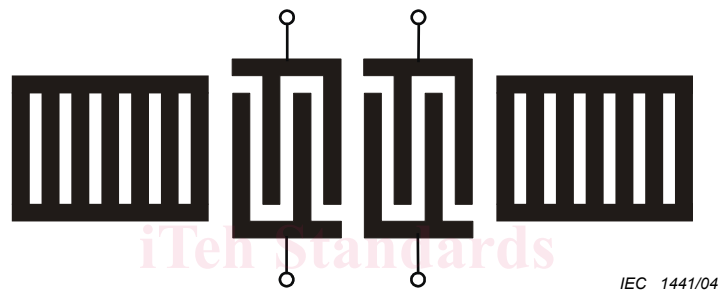
4.1.4

two-port resonator

SAW resonator having input and output ports (see 4.2.11 and Figure 1)



a) One-port resonator with opened arrays



b) Two-port resonator with shorted arrays

Figure 1 – Basic configurations of SAW resonators

4.1.5**SAW resonator oscillator**

oscillator that uses a SAW resonator as the main frequency controlling element

4.1.6**interdigital transducer (IDT)**

SAW transducer made of a comb-like conductive structure deposited on a piezoelectric substrate transforming electrical energy into acoustic energy or vice versa

4.1.7**finger**

element of the IDT comb electrode

4.1.8**dummy finger**

passive finger which may be included in order to suppress wave-front distortion

4.1.9**bus bar**

common electrode which connects individual fingers together and also connects the resonator to an external circuit

4.1.10**shorting bar**

common electrode which interconnects individual metal strips (see Figure 1)

4.1.11**apodization (spurious suppression for SAW resonator)**

weighting produced by the change in finger overlap over the length of the IDT to suppress the transverse spurious modes

4.1.12**SAW coupling coefficient**

$$k_S^2$$

SAW electromechanical coupling coefficient is defined as follows:

$$k_S^2 = 2 \left| \frac{\Delta v}{v} \right|$$

where $\Delta v/v$ is the relative velocity change produced by short-circuiting the surface potential from the open-circuit condition

4.1.13**grating reflector**

SAW reflecting array that normally makes use of the periodic discontinuity provided by metal strips, grooves or ridges

4.1.14**metal strip array**

periodic discontinuity realised by electrically short- or open-circuit metal strips providing electrical and mass-loaded perturbations

4.1.15**grooved array**

periodic discontinuity realized by topographic perturbation on a surface having shallow grooves

4.1.16**ridge array**

periodic discontinuity realized by the mass-loaded perturbation of the surface having thin layer strips

4.1.17**shorted array**

metal strip array interconnected with a shorting bar (see Figure 1b))

4.1.18**opened array**

metal strip array without a metal strip array interconnection (see Figure 1a))

4.1.19**mass loading**

perturbation in the SAW propagation caused by the mass of an overlay on the substrate surface

4.1.20**IDT aperture**

maximum IDT finger overlap length which approximately corresponds to the SAW beamwidth, where the aperture may be expressed in length units or normalized term of wavelength